

CLAIMS

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A system for controlling output power from an incoherently combined laser, comprising:
 - an external cavity providing feedback to an array of gain elements with said array of gain elements grouped into a plural number of gain blocks, each block comprising of one or more gain elements;
 - means for applying variable current to gain blocks to vary output power of said gain elements, said means for applying being operable to couple an independent current source to each gain block; and
 - a multiplexing element being operable to combine output beams from said array of gain elements.
2. The system of claim 1 wherein said feedback to said array of gain elements causes each said gain elements to lase at a unique center wavelength.
3. The system of claim 2 wherein center wavelengths of adjacent gain elements of a gain block are separated by 10 nm or less.
4. The system of claim 1 wherein said independent current sources coupled to said plural number of gain blocks cause each gain element of said gain block to operate significantly above a threshold current for lasing.
5. The system of claim 1 wherein said feedback causes gain elements of a first gain block to emit light at shorter wavelengths than light emitted by gain elements of a second gain block.
6. The system of claim 5 wherein spacings between adjacent gain elements of said first gain block are closer than spacings between adjacent gain elements of said second gain block.

7. The system of claim 1 further comprising:
a Raman gain medium for receiving said output beams.
8. The system of claim 7 wherein said output beams are operable to generate appreciable Raman gain in said Raman gain medium on at least one wavelength within the range of 1530 to 1565 nm.
9. The system of claim 7 wherein said output beams are operable to generate appreciable Raman gain in said Raman gain medium on at least one wavelength within the range of 1570 to 1610 nm.
10. The system of claim 7 wherein said output beams are operable to generate appreciable Raman gain in said Raman gain medium on at least one wavelength within the range of 1430 to 1530 nm.
11. The system of claim 7 wherein said output beams are operable to generate appreciable Raman gain in said Raman gain medium on at least one wavelength within the range of 1615 to 1660 nm.
12. The system of claim 1 wherein said array of gain elements comprises semiconductor material from the list of:

GaAlAs;
GaAs;
InGaAs;
InGaAsP; and
AlGaInAs
13. The system of claim 1 wherein gain elements of said array of gain elements are selected from the list of:

edge emitters;
vertical cavity surface emitting lasers; and
grating surface emitting lasers.

14. The system of claim 1 further comprising:
means for modifying polarization states of said output beams.
15. The system of claim 1 wherein said external cavity comprises an optical wavelength multiplexing assembly comprising:
a collimating optic; and
a dispersive element.
16. The system of claim 15 wherein said dispersive element is selected from the list of:
reflective diffraction grating;
transmission diffraction grating;
prism; and
hologram.
17. The system of claim 1 wherein said external cavity comprises an optical wavelength multiplexer selected from the list of:
a Mach-Zehnder interferometer; and
an arrayed waveguide grating.
18. The system of claim 1 wherein said external cavity, said means for applying, and said multiplexing element belong to a first incoherently beam combined laser, and wherein said system further comprises:
a second incoherently beam combined laser; and
a multiplexer for multiplexing output beams from said first incoherently beam combined laser and from said second incoherently beam combined laser.
19. The system of claim 1 wherein said external cavity, said means for applying, and said multiplexing element belong to an incoherently beam combined laser, and wherein said system further comprises:
a semiconductor laser capable of operating at an output power of at least 100 mW; and
a multiplexer for multiplexing output beams from said incoherently beam combined laser and from said semiconductor laser.

20. A method of providing a spectrally tailored Raman pump, comprising the step of:

- disposing a plural number of groups of one or more gain elements in one external cavity;
- coupling a current source to each group of one or more gain elements;
- operating said groups of one or more gain elements in said at least one external cavity to emit output beams; and
- combining said output beams utilizing said at least one external cavity.

21. The method of claim 20 wherein a first group of gain elements emits shorter wavelengths than wavelengths emitted by a second group of gain elements, and wherein said first group of gain elements possesses spacings between adjacent gain elements of said first group that are smaller than spacings between adjacent gain elements of said second group of gain elements.

22. The method of claim 20 further comprising the step of:

- modifying polarization states of said output beams.

23. The method of claim 20 further comprising:

- providing said output beams into a Raman gain medium.

24. The method of claim 23 further comprising:

- generating appreciable Raman gain for at least one wavelength within the range of 1430 to 1660 nm utilizing said output beams as a Raman pump.

25. The method of claim 23 wherein said step of generating appreciable Raman gain generates reasonably flat Raman gain for wavelengths across the range of 1530 to 1610 nm.

26. The method of claim 20 wherein said step of operating causes each gain element of said groups of gain elements to operate significantly above a threshold current for lasing.

27. A Raman amplifier comprising:
a plurality of gain element groups, each of said gain element groups
comprising a plurality of gain elements, and each of said gain element groups
being coupled to a respective current source;
at least one external cavity, said at least one external cavity configured to
provide feedback to said plurality of gain element groups, and said at least one
external cavity being operable to combine output beams emitted from said
plurality of gain element groups; and
a Raman gain medium receiving said output beams, said output beams
being operable to generate Raman gain in said Raman gain medium.

28. The Raman amplifier of claim 27 further comprising:
a polarization combiner being operable to combine output beams from at
least two external cavities.

29. The Raman amplifier of claim 26 further comprising:
means for modifying polarization states of said output beams.

30. The Raman amplifier of claim 29 wherein said means for
modifying comprises birefringent material.

31. The Raman amplifier of claim 29 wherein said means for
modifying comprises a polarization splitter and a polarization combiner.

32. The Raman amplifier of claim 27 wherein each of said respective
current sources are operable to cause gain elements of said gain elements group to
operate significantly above threshold current levels for lasing.

33. The Raman amplifier of claim 27 further comprising a multiplexer
to couple output beams from separate external cavities.

34. The Raman amplifier of claim 27 further comprising:
a narrow bandwidth laser device being operable to emit a narrow
bandwidth output beam; and

a multiplexer being operable to couple said output beams from said gain element groups with said narrow bandwidth output beam to provide multiplexed output beams to said Raman gain medium.

35. The Raman amplifier of claim 34 wherein said multiplexed output beams are operable to generate reasonably flat Raman gain across the range of wavelengths from 1530 to 1610 nm in said gain medium.

36. The Raman amplifier of claim 27 wherein said output beams generate reasonably flat Raman gain across the range of wavelengths from 1530 to 1610 nm in said gain medium.